

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : A23K 1/00, A61K 9/16	A1	(11) International Publication Number: WO 98/03081 (43) International Publication Date: 29 January 1998 (29.01.98)
(21) International Application Number: PCT/US97/01034 (22) International Filing Date: 21 January 1997 (21.01.97) (30) Priority Data: 08/684,785 22 July 1996 (22.07.96) US (71) Applicant: WISCONSIN ALUMNI RESEARCH FOUNDATION [US/US]; 614 Walnut Street, Madison, WI 53705 (US). (72) Inventors: COOK, Mark, E.; 15 Kewaunee Court, Madison, WI 53705 (US). JEROME, Daria, L.; Apartment 204, 5730 Highland Way, Middleton, WI 53562 (US). (74) Agents: HAAS, George et al.; Quarles & Brady, 411 East Wisconsin Avenue, Milwaukee, WI 53202-4497 (US).		(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>
(54) Title: METHOD OF IMPROVING THE GROWTH OR THE EFFICIENCY OF FEED CONVERSION OF AN ANIMAL AND COMPOSITIONS FOR USE THEREIN (57) Abstract A method of improving the efficiency of an animal to convert feed into desirable body tissue involves feeding the animal feed particles having an inner core of nutrients and an outer layer of fat containing antibodies which can protect the animal from contracting diseases than can adversely affect the animal's ability to grow or efficiently convert its feed into body tissue.		

BEST AVAILABLE COPY

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakhstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

-1-

METHOD OF IMPROVING THE GROWTH OR THE
EFFICIENCY OF FEED CONVERSION OF AN ANIMAL
AND COMPOSITIONS FOR USE THEREIN

Field Of The Invention

The present invention relates generally to the feeding of animals. More particularly, it relates to a method of improving the animal's growth or the efficiency of the animal to convert its feed into desirable body tissue (e.g. muscle) and compositions for use in the method.

Background Of The Invention

It is known that healthy, disease-free animals grow faster or are more able to convert their feed efficiently into body tissue than sick or immune-challenged animals. Obviously, faster growth or a more efficient conversion of feed into desirable body tissue in an animal is both economically and ecologically important, especially in animals raised for food. For this, and other reasons, it is desirable to prevent animals from contacting diseases.

One approach to keeping animals healthy is to give the animals antibiotics. However, that approach is not desirable for animals raised for food because there can be antibiotic residues in the food.

Another approach to keeping animals healthy is to immunize the animals. This can be done by vaccinating the animals against specific diseases to produce an active immunization or by administering to the animals antibodies to produce a passive immunization.

In United States Patent Numbers 4,748,018 and 5,080,895, methods are disclosed for passively immunizing animals against intestinal diseases which could interfere with the animal's efficient conversion of feed. The patented methods basically comprise orally administering to said animals effective amounts of egg-derived materials containing avian antibodies which are obtained by immunizing egg-laying hens with specific antigens which will produce such antibodies, and obtaining the antibody containing material from eggs laid by the hen. In

both patents, the antibody containing egg materials are reduced to powders and fed to the animals to be passively immunized.

Brief Summary Of The Invention

5 It is the primary object of the present invention to disclose a novel method to improve the animals growth or the efficiency of the animal to convert its feed into desirable body tissue.

10 Another object of the invention is to disclose an animal feed for animals for use in the inventive method.

15 The method of the present invention to improve the animals growth or the efficiency of the animal to convert its feed into desirable body tissue comprises orally administering to said animal feed particles having an inner core comprising primarily non-fat nutrients and an outer layer of fat which contains a safe and effective amount of antibodies that help protect the animal from disease or other antigens that can adversely affect the animal's growth or the efficiency of the animal to convert feed into desirable body tissue.

20 The compositions of the present invention are animal feed particles having an inner core comprised of nutrients, such as proteins and carbohydrates, and an outer layer of fat that contains the antibodies encapsulated therein.

25 The compositions of the present invention are conveniently made by first forming a nutrient mixture to produce an inner core, and then coating the outer surface of the core with a layer of fat containing antibodies encapsulated therein so the antibody is stabilized and substantially protected against antibody destroying factors, such as environmental conditions and intestinal proteases.

30 In an especially preferred embodiment of the invention, the antibodies in the fat are obtained from the egg of a hen which has been injected with an antigen that results in the production by the hen of those antibodies.

35

Compositions of the present invention are superior to previously known animal feeds in which antibody-containing powders were mixed with nutrients, including fat, and then granulated or extruded because the fat layer in the method of the present invention is applied to the core after the pelletization, extrusion, granulation or expansion process. As a result the antibodies in the outer fat layer of the compositions of the present invention are not degraded by elevated temperatures that can arise during pelletization, granulation, extrusion or expansion processes. The compositions of the present invention are also superior to prior art feeds because the outer layer of fat in which the antibodies are encapsulated helps protect the antibodies from stomach acid and intestinal enzymes.

Description Of The Preferred Embodiment

In the preferred embodiment of the present invention, the animal feed particles comprise an extruded inner core which contains primarily the desired non-fat materials, such as proteins and carbohydrates, and an outer layer of fat which contains the antibodies encapsulated therein. The outer layer also can contain other ingredients, such as oil soluble vitamins and the inner core can, of course, also contain fat, if desired.

In the preferred practice of the method of invention, the animal feed with the antibody-containing outer layer is orally fed to the animal in an amount which will passively immunize the animal.

The antibodies for use in the present invention are those which can alter physiological processes that adversely affect growth and feed efficiency. They can be antibodies that are against diseases or specific endogenous regulators of food intake and gastrointestinal motility. The antibodies are preferably derived from the eggs of hens which have been previously immunized to produce those antibodies as described in United States Patent Number 4,748,018 or 5,080,895. Especially preferred as the antibody-containing material are

-4-

spray dried egg yolks and whole eggs. However, other non-egg derived antibody-containing materials may be used.

The preferred inner core for the animal feed particles is an extrusion which contains a mixture of nutrients, such as grains, with or without added sugars, carbohydrates and/or proteins. The core will normally contain less than the desired total amount of the dietary fat for the animal because of the fat in the outer layer.

The fat for use in the outer layer to encapsulate and protect the antibody can be any fat or lipid, which can be readily mixed with the antibody containing material to form a mixture, which contains the antibody encapsulated therein and which can be readily sprayed or otherwise coated on the outer surface of the core. Especially preferred are those fats which are solid at ambient temperatures and which will protect the antibodies from adverse environmental conditions and intestinal enzymes. Especially preferred as the fat is a mixture of tallow and conjugated linoleic acid (CLA) which also is known to increase feed efficiency.

Representative of other fats that can be used are the following:

Lard
Yellow Grease
Poultry Fat
Spent Restaurant Oil
Animal Oils
Vegetable Oils
Fish Oils
Oil Derivatives, i.e. lecithin
and
Mixtures thereof.

The practice of the present invention is further illustrated by the following examples:

Example 1

Preparation Of Antibodies.

An antigen, such as cholecystokinin peptide which produces cholecystokinin (CCK) antibodies, is injected intramuscularly into mature hens at a dose of about 50 mg to 1000 mg with a water-in-oil emulsion adjuvant. Samples of the whole eggs or yolks of eggs from the hens are assayed

by known methods for CCK antibody content. When the CCK antibody titer reaches a maximum level, the whole eggs or yolks of eggs are collected and pooled, homogenized and spray dried to obtain a powder.

5

Example 2

Preparation Of Animal Feed Particles With Outer Layer Of Fat Containing Antibodies.

A CCK antibody-containing powder made by the process of Example 1 is mixed with tallow to form a blend in which
10 the powder is substantially encapsulated by the fat. The fat mixture is then spray coated upon inner cores made by the pelletization, the granulation, the extrusion or the expansion of a plasticized mixture of nutrients, including carbohydrate, protein and water. The resulting animal feed
15 particles have an inner core of nutrients and an outer layer of fat containing CCK antibodies.

Example 3

Animal Feeding Test.

Ducks are fed the animal feed of Example 2 and their
20 biological responses are determined. It is found that the ducks receiving the animal feed of Example 2 demonstrate an improved body weight gain and a more efficient rate of feed conversion than control ducks.

Table 1 shows the results obtained in 14 day old ducks
25 fed a control feed and an otherwise identical feed (BRAVO) having an outer antibody-containing layer.

TABLE 1

ABOVE BODY WEIGHT SUMMARY			
TREATMENT	14 day weight	27 day weight	14-27 day gain
Control	0.66 kg	2.03 kg	1.37 kg
Bravo	0.63 kg	1.96 kg	1.33 kg
TREATMENT	39 day weight	14-39 day gain	
Control	3.15 kg	2.49 kg	
Bravo	3.23 kg	2.60 kg	
FEED CONVERSION DATA			
TREATMENT	14-27 feed/bird	0-27 feed/bw*	14-17 feed/gain
Control	2.50 kg	0.558 kg	0.826 kg
Bravo	2.34 kg	0.541 kg	0.798 kg
TREATMENT	14-39 feed/bird	0-39 feed/bw*	14-39 feed/gain
Control	5.349 kg	0.781 kg	0.985 kg
Bravo	4.930 kg	0.695 kg	0.863 kg

* bw = body weight

It will be apparent to those skilled in the art that the present invention can be used to prepare the animal feed for a wide variety of food animals, including without limitation, ducks, chickens and turkeys.

5 It also will be readily apparent to those skilled in the art that a large number of changes and modifications can be made without departing from the spirit and scope of the present invention. Therefore, it is intended that the invention only be limited by the claims which follow.

We claim:

1. A method to improve the growth of an animal or the efficiency of an animal to convert feed into desired body tissue, said method comprising feeding an animal an effective
5 amount of animal feed particles comprising an inner core of nutrients and an outer layer of fat having antibodies encapsulated therein,
said antibodies being antibodies that can passively immunize the animal against the adverse effects of an antigen
10 which could reduce the animal's ability to grow or to efficiently convert its feed into desirable body tissue.
2. A method of Claim 1 in which the antibodies are derived from a chicken egg.
3. A method of Claim 1 in which the fat is an edible fat.
4. A method of Claim 1 in which the fat is one which protects the antibodies from adverse environmental conditions.
5. A method of Claim 1 in which the fat is a mixture of a conjugated linoleic acid and another fat.
6. A particulate animal feed comprising an inner core of nutrients containing carbohydrates and proteins and an outer layer of an edible fat having antibodies encapsulated therein.
7. An animal feed of Claim 6 in which the antibodies are derived from a chicken egg.
8. An animal feed of Claim 6 in which the fat is a mixture of a conjugated linoleic acid and another fat.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 97/01034

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 6 A23K1/00 A61K9/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 A23K A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 241 441 A (MEDIPHARM AB) 14 October 1987 see page 3, line 21 - page 5, line 22 see claim 1 ---	1,6
Y	WO 94 21284 A (PHARMA PACIFIC PTY LTD ;CHANDLER DAVID SPENCER (AU); REED BENJAMIN) 29 September 1994 see page 9, line 6 - line 12 see examples 2,3 see claims 1,12,14,16,18 ---	1,6
A	EP 0 426 463 A (VALIO MEIJERIJEN) 8 May 1991 see page 3, line 54 - line 56 see claims 1,9,11 --- -/--	1,6



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"A" document member of the same patent family

Date of the actual completion of the international search

3 July 1997

Date of mailing of the international search report

14. 07. 97

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentaan 2
 NL - 2280 HV Rijswijk
 Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl,
 Fax (+ 31-70) 340-3016

Authorized officer

Dekeirel, M

INTERNATIONAL SEARCH REPORT

Int. .onal Application No
PCT/US 97/01034

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 91 01803 A (AGRONOMIQUE INST NAT RECH) 21 February 1991 see page 1, line 12 - line 23 see page 4, line 35 - page 5, line 12 see claims 1,11,27,34-36 ---	1,6
A	EP 0 231 817 A (BUEHLER AG GEB) 12 August 1987 see claims 1,2,4,5 ---	1,6
A	EP 0 707 798 A (CHEVITA GMBH) 24 April 1996 see example 3 see claim 1 ---	1,6
A	EP 0 556 883 A (GIST BROCADES NV) 25 August 1993 see claims 1-5 ---	1,6
A	WO 96 04933 A (WISCONSIN ALUMNI RES FOUND) 22 February 1996 see page 9, line 22 - page 10, line 6 see example 7 see claims 1,28,41-47 ---	1,2,6-8
P,A	WO 96 22028 A (GRAMPIAN PHARM LTD ;LAVERY MARTIN (GB)) 25 July 1996 see page 3, line 31 - line 36 see example 3 see claims 1,6,10 -----	1,6

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 97/01034

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0241441 A	14-10-87	SE 454230 B DE 3775593 A SE 8601543 A US 4943437 A	18-04-88 13-02-92 08-10-87 24-07-90
WO 9421284 A	29-09-94	AU 673589 B AU 6278794 A EP 0706400 A JP 8509965 T	14-11-96 11-10-94 17-04-96 22-10-96
EP 0426463 A	08-05-91	JP 3169337 A US 5104662 A	23-07-91 14-04-92
WO 9101803 A	21-02-91	FR 2650758 A EP 0437598 A	15-02-91 24-07-91
EP 0231817 A	12-08-87	CH 666386 A DE 3772399 A	29-07-88 07-11-91
EP 0707798 A	24-04-96	NONE	
EP 0556883 A	25-08-93	JP 6505881 T WO 9314645 A NO 933400 A	07-07-94 05-08-93 17-11-93
WO 9604933 A	22-02-96	AU 3103495 A CA 2196594 A EP 0769964 A	07-03-96 22-02-96 02-05-97
WO 9622028 A	25-07-96	AU 4395396 A	07-08-96

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☒ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☒ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.